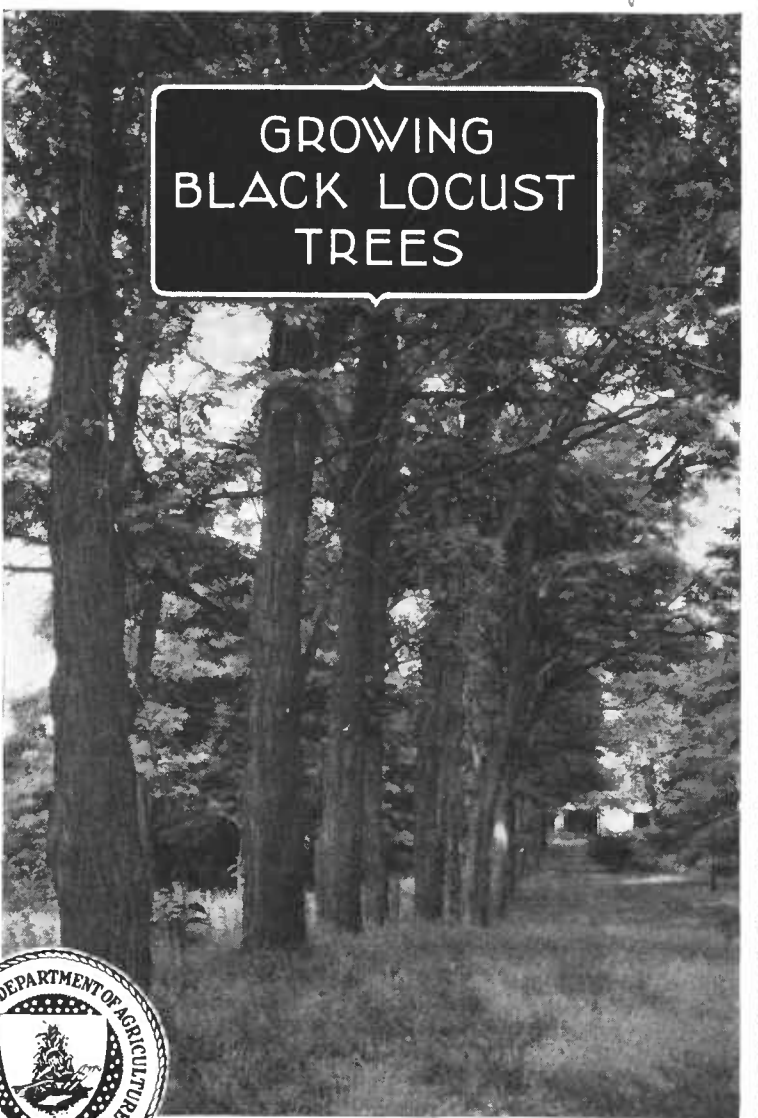
U. S. DEPARTMENT OF AGRICULTURE

FARMERS' BULLETIN No. 1628 REV.
May 1937



TREES PRODUCING WOOD that is durable when used in the ground are in special demand. Among the few native trees of this kind the black locust ranks very high. It is much in demand for use as fence posts, stakes, and poles.

Black locust has a strong, spreading root system which makes it of much value in checking erosion. Probably no other forest tree is being planted so extensively for erosion control. It is a legume, which in part accounts for its power of growth in lean soils and makes it an outstanding soil builder.

A serious menace, however, to the growth of black locust is an insect known as the locust borer. Yet in many localities black locust can be grown successfully and profitably. In other localities the injury done by this insect makes attempts to grow the tree almost impracticable. Black locust, like most forest trees, is naturally better adapted to certain types of soils and situations than others.

The vigor of the tree apparently to a great extent determines the degree of attack by the locust borer. Fortunately the tree's vigor can within limits largely be determined by man through the selection of the soil or site for planting, the method of planting, and subsequent care and cultivation.

Before attempting to plant black locust on a considerable scale, it would be advisable to secure information and advice from one or more of the local State forestry agencies, as a necessary supplement to that contained in this bulletin.

Washington, D. C.

Issued May 1930
Revised May 1937

GROWING BLACK LOCUST TREES

By WILBUR R. MATTOON, *extension forester, Division of Private Forestry, Forest Service*

CONTENTS

BLACK OR "YELLOW" LOCUST (*Robinia pseudoacacia* L.) makes rapid growth on good soils, grows moderately well on fairly poor and dry soils, is easily propagated, and produces very durable wood. It is a legume, and by virtue of its root nodules it enriches the soil. Its strong spreading root system and rapid development give it high rank among all trees in ability to check erosion in gullies and on steep hillsides. Its very durable wood makes it widely sought and used for fence posts, stakes, and poles.

The flowers are a source of large amounts of honey of good quality.

The increasing scarcity of chestnut for posts, poles, and stakes has done much to stimulate interest in the possibilities of growing black locusts for those uses. The expansion of the livestock business, including dairying, calls for greater numbers and better kinds of posts.

Many farmers would profit by planting a patch of black locust trees to supply fence posts.

The black locust has a dangerous insect enemy known as the black locust borer. The menace of this insect should be carefully considered before choosing black locust as a tree to plant. Accompanying shipments of young locust trees from the Eastern States, the locust borer has been introduced into many of the States of the Rocky Mountain region and is there becoming a serious pest. It is present almost everywhere that black locust is grown, except in some of the States of the extreme West.

In many localities, however, black locust is extensively grown with fair to good success and profit as the insects, although present, are not a serious pest. The recent extensive developments by State and Federal agencies in the checking of soil erosion have resulted

since 1933 in the greatest known era of growing and planting black locust seedlings.

The black locust was introduced into Europe more than a century ago and has been extensively planted and is greatly appreciated.

WHERE BLACK LOCUST GROWS

Black locust is found widely over the United States, especially in the eastern half. Its native or original home, however, was probably in the Appalachian Mountains, including the outlying piedmont, where it grew singly or in small groups among other hardwood trees.

Black locust is generally recommended for planting from southern New England through New York and Pennsylvania, south to Georgia, and west as far as Illinois, Missouri, and Texas. Limestone soils and the brown loams and other well-drained areas in the lowlands of the central Mississippi Valley are particularly favorable for its rapid growth. Black locust has spread over the Arkansas-Missouri-Oklahoma uplands. Under irrigation it is proving successful and valuable in many parts of the Western States.

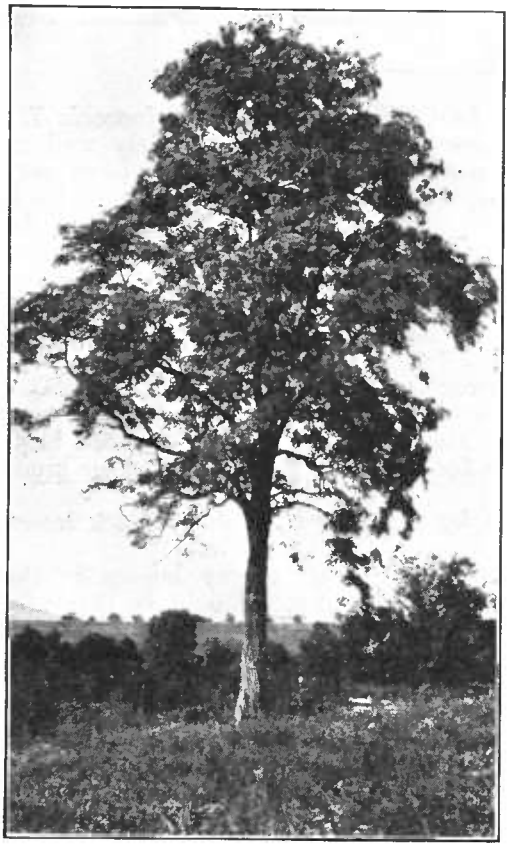


FIGURE 1.—Growing alone in the open, black locust makes a well-shaped tree with branches that droop at the ends. It is handsome when in full bloom.

In certain regions the climate seems to be unfavorable for the growth of locust. For example, northern New England, and some of the lake States appear to be too cold for successful commercial plantations and most of the southern coastal plain too hot. Serious losses from the locust borer have been reported from various places in Pennsylvania, from the low country of the Ohio River Valley and other parts of Ohio and Kentucky, from parts of Indiana and of the Iowa-Missouri area. However, locust is successfully grown in various other places in these States, and the State forestry agencies of practically all of these States are recommending the planting of locust. The explanation seems to lie largely in the favorableness or unfavorableness of the soil.

Black locust is seldom found and should not be planted in very sandy, very dry, very poor, very acid, or poorly drained soils. It grows best on alkaline, nonacid, or moderately acid soils (fig. 1). In its ability to grow on well-drained locations, such as banks and hillsides, black locust ranks high among the native trees.

USES OF THE WOOD

The wood is heavy, hard, and very durable. For durability in the ground the wood ranks higher than that of all other native trees except Osage-orange or bois d'arc ("bow-dark"). It is extensively used for fence posts, the heartwood lasting from 15 to 30 years and sometimes more than 50 years. The heartwood of young trees, however, seems to be less durable than that of older trees, and it should always be well seasoned before being used. Locust is also used for grape stakes, poles, insulator pins, and treenails for shipbuilding. The trunk is nearly all heartwood, which is formed comparatively early in the life of the tree. It is good practice to peel the bark before using the wood for posts or poles (figs. 2 and 3).

FIGURE 2.—Black locust wood is hard and exceptionally durable when in the ground. It makes the best fence posts. This 14-by 14-inch locust post was in good condition after 55 years of service.

FIGURE 3.—Black locust is in good demand for use in making fence posts, stakes, insulator pins, and treenails.

BLACK LOCUST FOR CHECKING EROSION

Black locust is widely recognized as a tree of exceptional value for checking soil erosion and washing and for that purpose has come to be used extensively in many regions. It is often seen growing naturally on steep banks along roadsides or railroad cuts and fills.

Often it is the only tree found in such places. It reproduces itself freely from root suckers as well as from stump sprouts.

The earliest extensive plantings for checking erosion are to be found in the brown of loessial silt loam soils over western Tennessee. Since 1914, in cooperation with landowners, the State forest service has assisted in the reforesting of several thousand acres. These landowners became demonstrators in stopping soil washing and gullying.

The approval in 1933 of an extensive Federal flood-control project in the central Mississippi River Basin by means of revegetating eroding lands started the planting of black locust on a vast scale (fig. 4). In the 3 following years about 250 million seedlings of black locust were planted for that purpose.

GROWTH

The rate of growth of black locust varies widely in different soils and climates in the United States, ranging all the way from extremely fast to very slow. Much depends also upon the spacing or tree density on the ground. Open-spaced trees grow more rapidly in diameter than closely grown trees. Where the soil and climate are favorable the growth should average from 2 to 4 feet in height a year and from one-quarter to one-half inch a year in diameter after the first few years.

Under such conditions it grows rapidly and yields fence posts in 10 to 20 years. In poor, very acid, or dense soils, including subsoils in borrow pits and on badly eroding slopes where locust often spreads naturally, growth is usually slow. Slightly acid soils seem favorable. In good soils, especially deep loamy soils, early growth is sometimes phenomenally rapid, up to 10 feet a year (fig. 5).

In well-spaced stands on average-quality soil within the region of fair to good growth, the trees may be expected at 15 years of age to reach average heights of 20 to 30 feet and diameters (outside the bark at breast height) of 3 to 5 inches; and at 20 years, diameters of 4 to 7 inches. In overcrowded stands or in poor locations the trees may be expected to be smaller, while in favorable situations they will usually be even larger.

In any situation black locust is a tree that reaches commercial maturity comparatively early; it should be cut usually before it is 25 to 30 years old. Under unfavorable conditions trees and stands after reaching an age of 15 to 20 years are often injured badly by insects and by heart rot diseases or fungi. Trees live for 40 or more years, in good soil and favorable regions, before showing signs of old age.

One of the essentials of good soil for growing locust is the presence of nitrifying bacteria, as indicated by the abundance of nodules on the roots. These bacteria seem to have a direct bearing on the growth and therefore the extent of attack by the locust borer. In places where the roots show relatively few nodules, the insect infectation is more serious than in places where the root nodules are abundant. Additional information about growth and insect attack is needed for different regions.

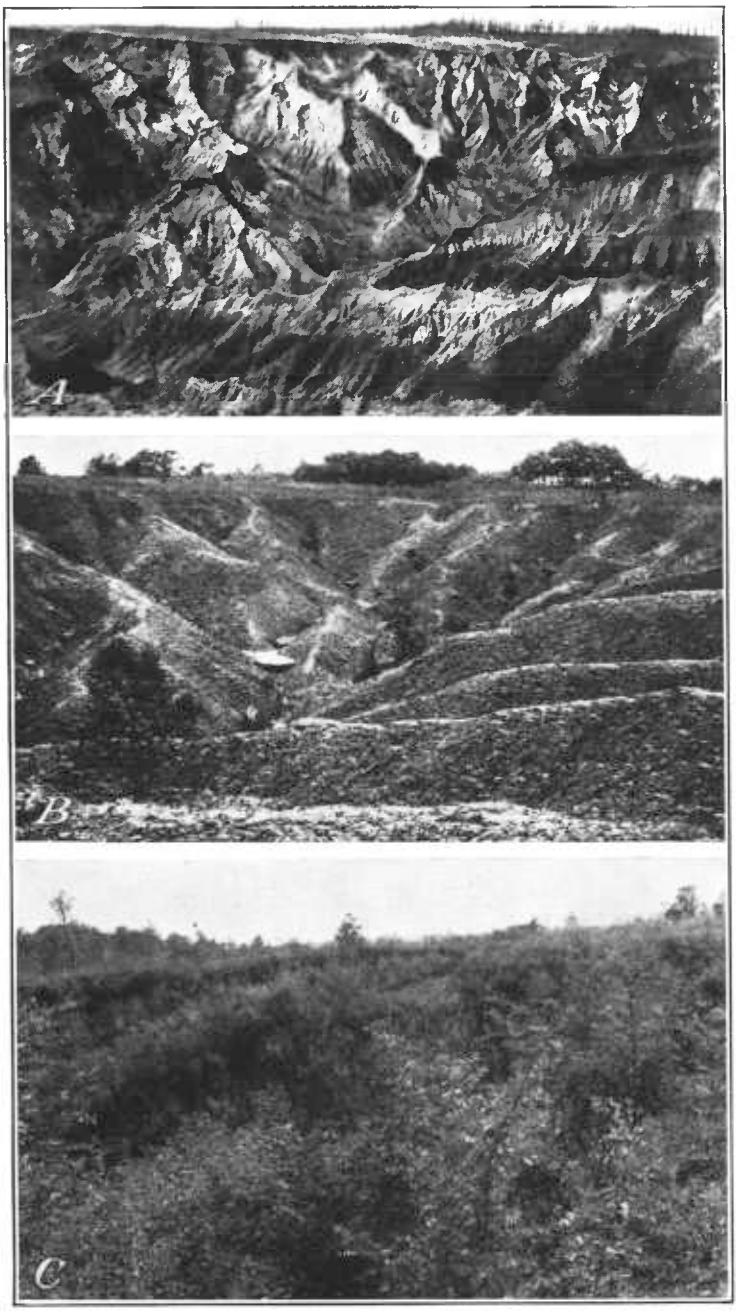


FIGURE 4.—The healing of the Borgsmiller farm gully in Jackson County, Ill., by black locust planted by the Civilian Conservation Corps under the direction of the Department of Agriculture: *A*, The gully before it was treated; *B*, the small check dams that were built and the banks that were sloped and planted with black locust seedlings—time, early spring; *C*, the gully completely reforested and producing a crop of timber—time, 1 year after *B* was taken.

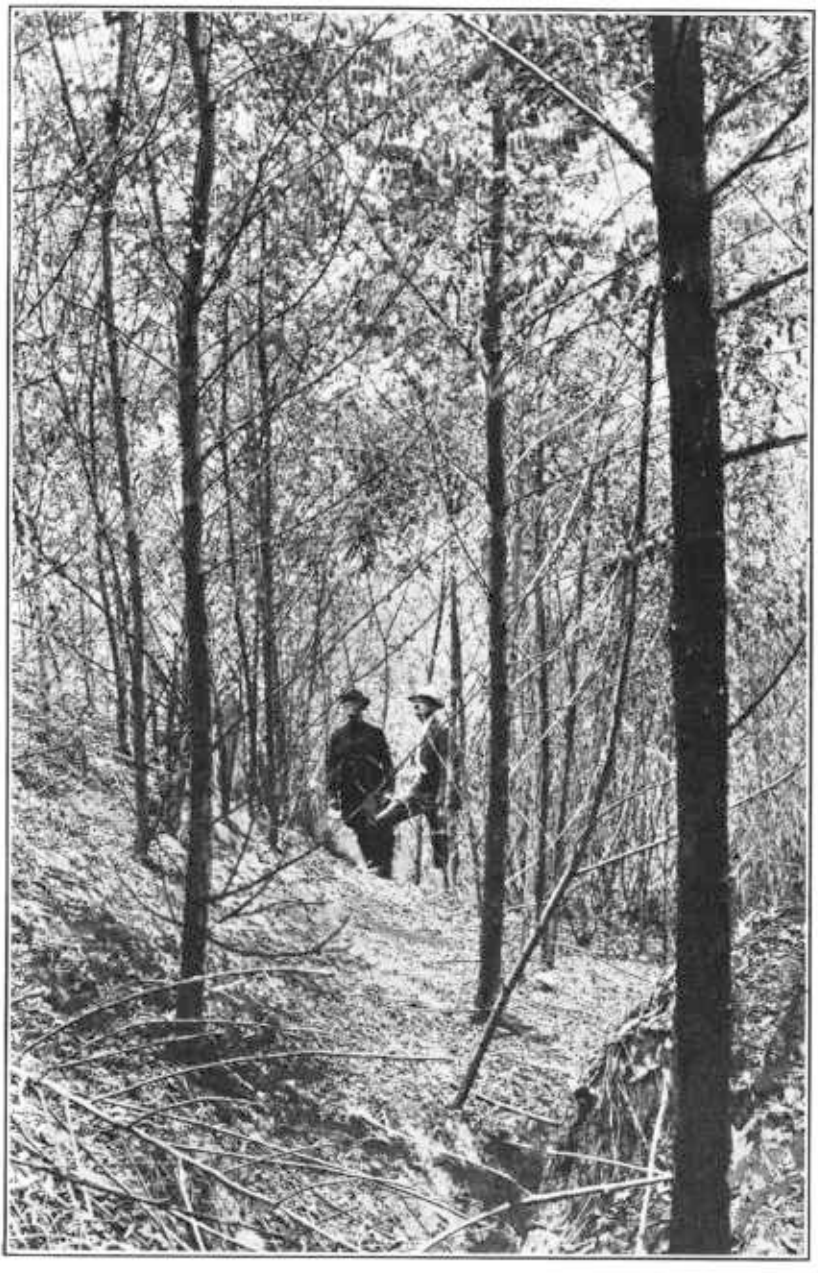


FIGURE 5.—Maximum growth of black locust planted to heal a gully, 25 feet in height at end of second year. Martin County, Ind.

GROWING BLACK LOCUST SEEDLINGS

The planting of black locust is recommended on good soils within the favorable regions above described. For the purpose of checking erosion it may be planted on poorer soils. The planting of black locust involves a risk of some damage and, in some localities, of serious loss because of the locust borer. In this connection too much emphasis cannot be laid upon the desirability of getting the advice of the State forester, of the State forestry organization, or of the State extension forester who is connected with the agricultural extension service. By planting on good soils, by interplanting with other heavy-foliaged trees, or by moderate spacing and good cultivation, black locust can often be grown with fair to good success in insect-infested localities. The secret in any case apparently lies in stimulating rapid growth of the tree and in shading the tree trunks, thus creating unfavorable conditions for the borer, which more often attacks portions of the tree exposed to direct sunlight.

HOW TO GET SEED AND SEEDLINGS

The black locust produces good seed in abundance. It also sprouts vigorously after being cut or killed back by fire. Thus, it is easy both to start a tract of young trees and to get another generation of trees following cutting. Planting is most likely to succeed when done with 1-year-old seedlings grown from seed. Direct seeding of the land where trees are desired should not be attempted. The seeds do not germinate freely without attention.

Locust plantations have been started with wild or dugup sprouts, but the method usually requires considerable labor and is relatively slow and costly. However, it saves 1 year over the method of raising seedlings in nursery beds. It is an easy matter to sow the seed in a garden or nursery bed and after one season have a supply of vigorous seedlings ready for planting. If seedlings are not available for purchase at a fair price, growing one's own seedlings will be the most satisfactory method of obtaining a supply. The seeds are contained in small pods and should be collected from the trees in the fall and kept stored over a winter in a cool, dry place.

Many of the State departments of forestry sell seedlings at nominal cost for planting on farms or elsewhere (fig. 6). Some of the more recently established governmental agencies furnish seedlings for demonstration purposes. Prices commonly range from 50 cents to $1 a pound for seed and from $3 to $5 a thousand for seedlings, depending largely on the size of the seedling as well as the order. Occasionally small lots of seed are furnished free by the State to adults or 4–H club members. Addresses of commercial dealers handling seed or seedlings can be obtained on request from various State forestry agencies or the Forest Service, United States Department of Agriculture.

COLLECTING AND CLEANING SEED

The seed of black locust ripens in pods in the early fall, and much of it often remains on the tree. The pods are collected preferably in the fall or early winter and during dry weather. Afterward

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there is a continuing loss of seed from the pods. Hand picking from a stepladder or short ladder is a common method. If cutting of trees is in progress, the pods may be picked most easily. When dried, the pods may be opened by flailing, beating, or rubbing. In large operations seeds are most easily extracted by using a grain separator or threshing machine, suitably adjusted for the purpose. Beating a strong sack filled with dry pods with a flail or club is a good method for small quantities.

The cost of collecting and cleaning seed varies widely with the quantity and method used. Under fair conditions, on an average, a man may collect about 2 pounds of pods per hour, or 14 to 20 pounds per day, which should yield from 3 to 5 pounds of clean seed. Scant data are available on the cost of extracting and cleaning black locust seed, but in fair-sized operations it should not cost over 3 cents

FIGURE 6.—Nursery beds of 1-season-old black locust seedlings. Small trees ranging in height from 12 to 18 inches and having taproots shaped like long slender radishes are most desirable for planting. (This State nursery in western Tennessee contained about 20 million black locust seedlings.)

per bushel. When a small home-made thresher with a capacity of 50 pounds of dry pods per hour was used, the cost was about 4 cents per pound of seed.

A bushel of pods weighs from 7 to 14 pounds, averaging about 10 pounds. The seed yield from different lots of seed varies greatly, ranging from 2 to 5 pounds of clean seed per bushel of pods, probably averaging about 3 pounds. This is at the rate of a pound of clean seed from 3½ pounds of pods. One quart of seed weighs from 1.4 to 1.8 pounds—or an average of 1.6 pounds. A pound of seed contains usually from 20,000 to 25,000, varying with the average size and density.

TREATING SEED TO AID GERMINATION

Black locust seed differs widely in its germination capacity. Sometimes only from 10 to 20 seeds out of every hundred germinate successfully; other lots of seed may have as many as 40 to 60 and occasionally 90. The average is low, perhaps from 30 to 40. The probable cause is the variation in hardness or density of the seed

coats and the consequently varying degree to which moisture, necessary for germination, passes through them.

Different treatments to increase germination have been worked out and tried, with varying results. (1) The one longest in use is the hot-water treatment. It consists of soaking the seed in warm water, starting at somewhat below the boiling point (about 160° F.), for 12 to 20 hours. (2) The chemical method is to treat the seed with sulphuric acid. (3) The mechanical treatment is to scarify, scratch, wear, or thin down the seed coats. Various means include agitating the seed in a revolving drum or other container in which it is mixed with sand or small gravel; shaking it in a sealed jar; tumbling it in some sort of a revolving hopper or drum in which baffle plates are fitted; or blowing it against a curved surface covered with a sharp sandpaper or garnet paper. This last method has given good results as it finely scratches the seed coats without cracking them and bringing about consequent loss of seed. There are various scarifying machines on the market designed for treating clover and other agricultural seed which, with simple modifications, can be successfully used for black locust seed.

The hot-water treatment is easy to apply and is known to hasten germination in many lots of seed, but in many others is ineffective because of the very hard and impermeable seed coats. The acid treatment requires much care in handling, including length of treatment. When rightly applied, it markedly aids germination, but at the same time causes losses of young seedlings under warm, wet soil conditions. The best combined results of germination and of hardiness of the resulting young seedlings have apparently been obtained when the seed was scarified. Much probably will be learned by means of further experiments. It might be advisable to treat a portion of the seed by one or more of the methods and observe the results as compared with sowing the seed without any special treatment.

Directions for treating black locust seed, if desired, will be furnished upon request if application is made to the regional forester, United States Forest Service, at Washington, D. C., at Atlanta, Ga., or at Milwaukee, Wis.

GROWING SEEDLINGS IN NURSERY

A good quality of agricultural soil, such as a deep sandy loam, should be chosen for the nursery site. Apparently a slightly acid soil gives the most favorable development of locust seedlings and at the same time freedom from disease (soils with a pH of about 5.00+).

It is essential to prepare the soil thoroughly in readiness for seed sowing and to mark out beds 4½ feet in width, with paths 18 or 24 inches in width. A farmer may not need more than a single bed. Generally, a bed 4½ feet in width by 25 feet in length (100 square feet of seeded bed) sown in drills 6 inches apart will require about one-third pound of seed and may be expected to produce from 800 to 1,500 or an average of 1,200 good or no. 1 locust seedlings.

Early spring is a favorable time for seed sowing in order to take advantage of the better soil moisture—an important requirement for good germination. One method is to sow seed in drills 4 feet

long, spaced 6 inches apart and running across the bed, to allow for hoe cultivation. The seeds may be sown about one-fourth inch apart with the expectation of obtaining germination and growth sufficient to get good seedlings every 2 inches apart. This would give an average of about 1,200 no. 1 seedlings on every 100 square feet of planted area, or allowing for beds 4½ feet in width, a gross area of 112½ square feet.

The seeds may be covered one-fourth inch in depth, preferably with a sandy loam soil which will not crust or bake in the sun after rains. A fundamental requirement is good moisture and warmth during the germination period, which in warm spring weather may be 10 to 14 days. To maintain such conditions a light mulch of clean straw, pine straw, or leaf litter is often desirable.

Much depends upon the weather conditions, which are normally variable from year to year as well as day to day. One method is to wait until late spring or early summer (June), sow the seed in beds that are well-soaked by rain or watering, cover the seed lightly with sifted soil, then mulch with straw or leaf litter to maintain good heat and moisture conditions. As soon as the seed begin to germinate it is very necessary to remove most of the mulch. This method of late sowing is often used where watering equipment is available to force the growth during dry spells. Otherwise the spring sowing is often best to take advantage of the spring moisture. Heavy watering during the season is usually inadvisable because it results in too large seedlings. A desirable size of seedling is from 12 to 18 inches in height. However, excellent results have followed with small trees averaging some less than 12 inches in height. In any event, a prime factor for good planting stock is a medium top and well-developed taproot like a long radish in shape. All seedlings with slender taproots may be regarded as culls, particularly if the tops are over 8 to 12 inches in length. If seedlings are 3 feet or more, they can be set with or without cutting back the tops. One-year-old seedlings are universally used, as 2-year stock is practically always too large to handle economically.

LARGE-SCALE PRODUCTION

An acre divided into beds 100 feet long and 4½ feet in width and separated by 18-inch paths, will have about 70 beds with an aggregate of 28,000 square feet of seeded bed. At the rate of 1,200 trees per 100 square feet of seeded bed there should be approximately 336,000 per acre. If there are only 8 seedlings instead of 12 per square foot, as may often happen, the production will be about 224,000 per acre. The common maximum is probably about 500,000, and the average probably about 300,000 per acre.

CARE OF NURSERY BEDS

The growing seedlings should be kept clean of weeds and given occasional cultivation. Except in the case of a real drought, it should not be necessary to water the beds. Medium-dry conditions will tend to develop desirable plants with small tops and large root systems. Any excess of rain or watering may result in too large stock, say from 2½ to 5 feet in height. Black locust withstands fairly dry conditions very well

PLANTING BLACK LOCUST SEEDLINGS

A FEW ESSENTIALS FOR SUCCESS

It may be well to mention a few of the essentials for success in planting, as far as known at the present time. Future research and observation will undoubtedly add to what is now known.

A prime essential for success in planting black locust seedlings is to break up or prepare the ground well. Pines may be set in firm soil; but to be successful, locust should be set in ground that has been well broken and worked to make a good plant bed. In such ground the lateral roots will find easy entrance and stimulate good top development. If planted in a small hole in hard though fertile soil, the locust may barely live for a year or more but seldom makes a normal growth.

The best time for planting or setting locust seedlings is in early spring before the buds begin to swell. If set out late in the spring after leafing starts, the seedlings should be cut back nearly to the ground. In loose soils locusts may be planted in the fall after good rains have wet the ground to a considerable depth. Fall planting is dangerous in all tight soils because of probable injury from frost heaving.

Seedlings with small spindling or threadlike taproots, or culls, probably come from undersized or weak seeds and even in good soil will not make satisfactory growth.

In planting, the seedling and particularly the roots should be kept moist at all times. Sometimes the planter drops the trees far ahead of the setting, and the tree dries; this may not kill the seedling but injures its vitality and chances of good growth.

If seedlings are to be held over or stored after digging they should be heeled in. The soil should be packed well around the root and lower stems and the ground kept moist. Heeled-in trees should be well shaded. Damage from root disease has been found in such storage in the South.

PREPARING THE GROUND FOR PLANTING

In advance of planting, the soil should be well prepared. Many failures or near failures can be traced directly to planting locust seedlings in hard ground. In abandoned fields it will usually not be difficult or costly to break the ground and disk or harrow it. Then it should be laid off in furrows with the desired spacing. If it is not practical to break all the ground by plowing, a good planting bed should be prepared by plowing at least two furrows running in the same direction. A better planting bed is made by running a middlebuster or lister plow and afterward throwing a furrow inward from each side (fig. 7). Successive planting beds should be made every 6 feet apart or other desired spacing.

In planting gullies, the best method is to plow down the banks beginning at the top. The next-best preparation is to plow a couple of furrows along a contour to make a planting bed in the form of a low terrace. This is repeated each 5 or 6 feet to the bottom. It is essential to plow down the gully edges in order to reduce the gradiant and throw topsoil into the gully bottoms to aid the vegetative growth. In large or deep gullies it is essential first to build a series of low check dams across the gully bottom at selected points

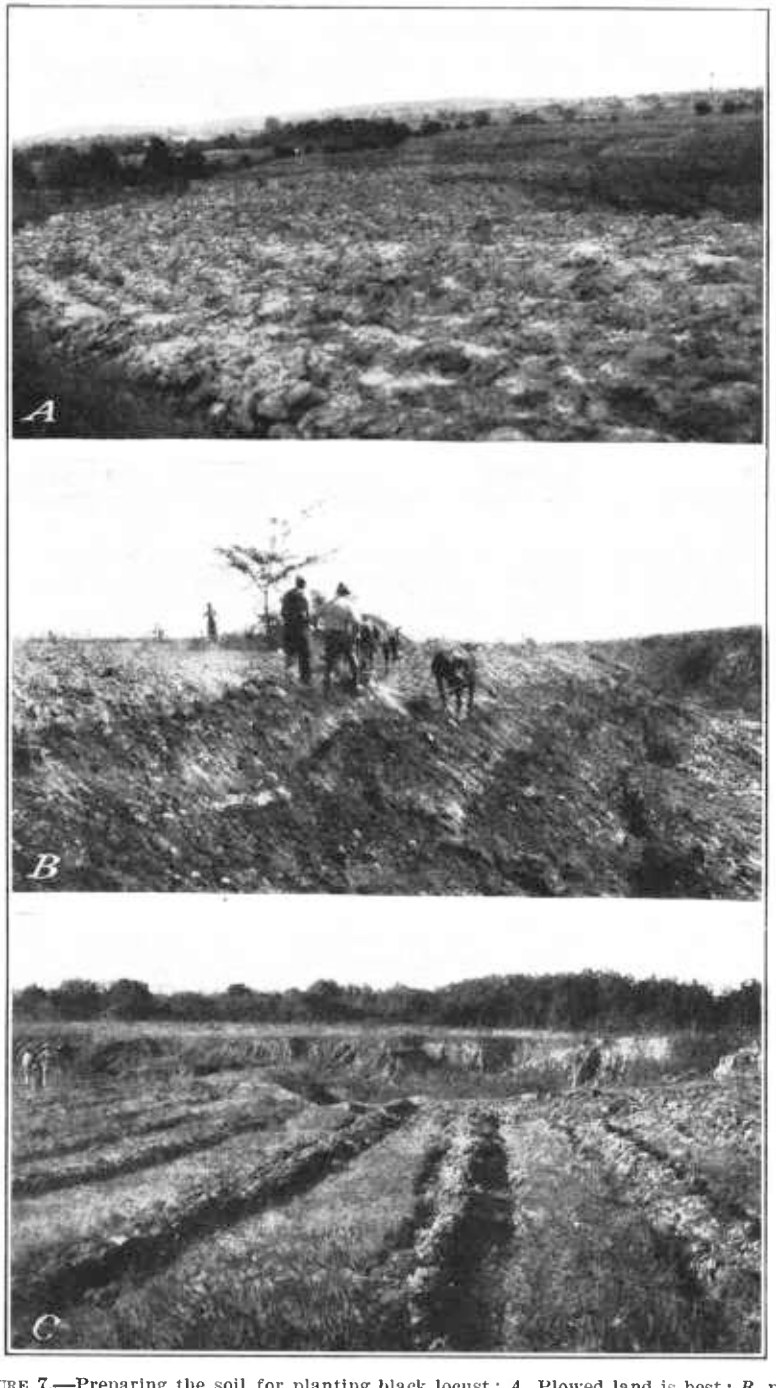

FIGURE 7.—Preparing the soil for planting black locust: *A*, Plowed land is best; *B*, plowing contour furrows 6 feet apart on slopes; *C*, bedding the soil by three to six furrows.

to catch and hold the soil later to be plowed off the edges and sides. All of the preparation requires work, but it is well worth the effort as it secures the desired results in holding the soil until the trees become well established.

To be effective, check dams in gullies must be carefully made. For brush dams use scrubby or low-grade trees or brush and cut the limbs and trunks into lengths of 4 feet or more, depending upon the width of the gully. Place these across the gully. Bind them by adding some long branches lengthwise of the gully, with the tops upstream. Build a compact structure and weight it down with heavy tree-trunk sections or with rocks. If necessary, drive stakes through the brush and limbs to secure the dam in time of flood. All dams should be low, often 18 inches but not to exceed 2 feet in height

FIGURE 8.—Before planting black locust or other vegetation to heal large gullies, it is essential to build low check dams to help hold the soil until the trees become well established.

(Fig. 8). The best time to make dams is in the summer, when the trees are in leaf. Dams built in the summer or fall should get a good catch of soil in which to set locust seedlings the following spring. Trees or other growth near gullies should not be cut, as their living roots and tops will be of much value in binding the soil and checking surface erosion. Other types of check dams are built of stone, logs, or other material, often with heavy chicken wire and grass, straw, or light tree tops. The dams, except those of stone, are temporary, and it is expected that they will be replaced by dams of living trees, grass, or vines.

DIGGING, STORING, AND TRANSPORTING SEEDLINGS

The aim should emphatically be to get the trees planted with the least possible delay after they are removed from the nursery bed. The digging, or lifting, and all subsequent handling of locust planting stock require special care. The soil about the roots should be

loosened with a spade, in small operations, or with a plow or special digging machine if the nursery is more extensive. The tops and larger roots should not be bruised or otherwise injured. It is almost always necessary to prune the taproots in addition to the slight pruning or breaking of the roots inevitable in the process of digging. Ten inches in length is about the maximum for taproots. It is important to sort and roughly grade the seedlings as follows: (1) Culls, to be discarded all of those with spindling or threadlike taproots; (2) usable seedlings divided into at least two groups, according to size. The seedlings should be tied into bundles of 50 or 100 each.

The bundles of trees should be transported so far as possible directly from the nursery to the planting site and there planted. Sometimes they must be held in readiness for planting later. This means that they must be heeled in at or near the nursery or the planting grounds. The essentials of heeling in are: (1) Selecting a cool and moist but well-drained place; (2) digging a trench with a sloping side piling all soil on the opposite side; (3) laying the bundles (opened by cutting the cord and spreading open the seedlings) consecutively in the trench against the sloping side and covering the roots and base of stems with soil well-packed, to exclude excess air; (4) watering the seedlings well, if the soil is not moist do not let the soil become dry at any time; (5) providing shade for the heeled-in beds during early fall or late spring when the sun is warm and the air often dry. This may consist of brush laid on elevated racks or stringers or clean grain straw loosely piled over the beds. A cellar or cool storage will keep the trees in good condition.

TRANSPORTATION

The essentials are to keep the trees moist and cool and to prevent mechanical injury. The small tree bundles may be made up in packages of 500 to 1,000 trees each, wrapped with burlap or heavy paper and tied. Wooden boxes or crates are often used for holding bundles of small trees. The greatest danger usually comes from the drying or the heating of the tops and roots, with resulting death or reduction in vitality of the trees.

SPACING THE TREES

The distance apart, and, therefore, the number of trees to be planted per acre, depends mainly upon the purpose of planting, upon topography, and upon soil conditions. A rather common spacing for tree production is 6 by 6 feet apart each way (Fig. 9). On eroding lands of gentle slope this should be a good spacing, but on steep slopes and gully banks where a soil binder is needed quickly a spacing of 5 by 5 feet, or occasionally a minimum of 4 by 4 feet, is desirable. These successive spacings require 1,210, 1,743, and 2,723 trees, respectively, per acre. The richer and moister the soil within certain limits the more rapidly the trees grow and the sooner their roots and their tops meet. Likewise on poorer or drier soil the opposite is generally true, and more trees per unit of area are usually planted.

PLANTING OR SETTING THE SEEDLINGS

The small trees are set much like cabbage or tomato plants. They should be set with the least possible delay after they are removed

FIGURE 9.—Worn-out farm field of about 6 acres planted with black locust 6 feet apart each way. Carlisle County, Ky. The trees are 25 to 35 feet in height at 8 years of age and making straight, valuable post timber.

from the nursery bed. It is of prime importance to keep the roots moist at all times and to set the trees firmly in the ground, with their roots spread out and not curled upward or bunched. Young black locusts set in cultivated or prepared ground usually grow well even if the fertility of the soil is low. Likewise, if they are set in small pockets in hard though good soil, the growth will be unsatisfactory (fig. 10). An impervious hardpan near the surface is practically fatal to their growth or survival.

The seedlings may be carried in buckets having water and should never be dropped ahead of setting. A crew of two men is often employed, one digging the holes and the other setting the trees. The tools most commonly used are a mattock or a light grub hoe. The number of the crew is varied, depending on the ease of planting; one

FIGURE 10.—Because the hard ground was not first broken up by plowing to make a loose planting bed, the results were poor. The trees were carried about in buckets containing water and carefully set in holes dug with a mattock. Because the roots could not expand rapidly the trees were stunted, and many died during dry periods.

digger may prepare the ground for two or more setters, or in hard ground it may be necessary for two men to dig the requisite large, well-cultivated holes or spots while one man sets the trees. Planting is done by holding the tree in a normal position while carefully drawing in the soil around and over the roots. The soil should always be well firmed with the foot about the tree, and preferably some loose litter should be spread over the surface as a mulch.

In loose soil the slit method of planting is very often used. It consists of making a wedge-shaped opening with a mattock, spade, or dibble, in which the tree is held and the soil pressed and firmed. The latter tool consists of a narrow, flat iron blade and extended handle. Although not usually as good a method for getting the roots well placed, this is a rapid and often a satisfactory method.

The best method of preparing gully banks for planting is to plow the banks on the contour, solid if possible, otherwise open a single

or a double furrow in which to plant the trees. On smooth gully banks, the "pocket" method should be used. An ample pocket or shelf

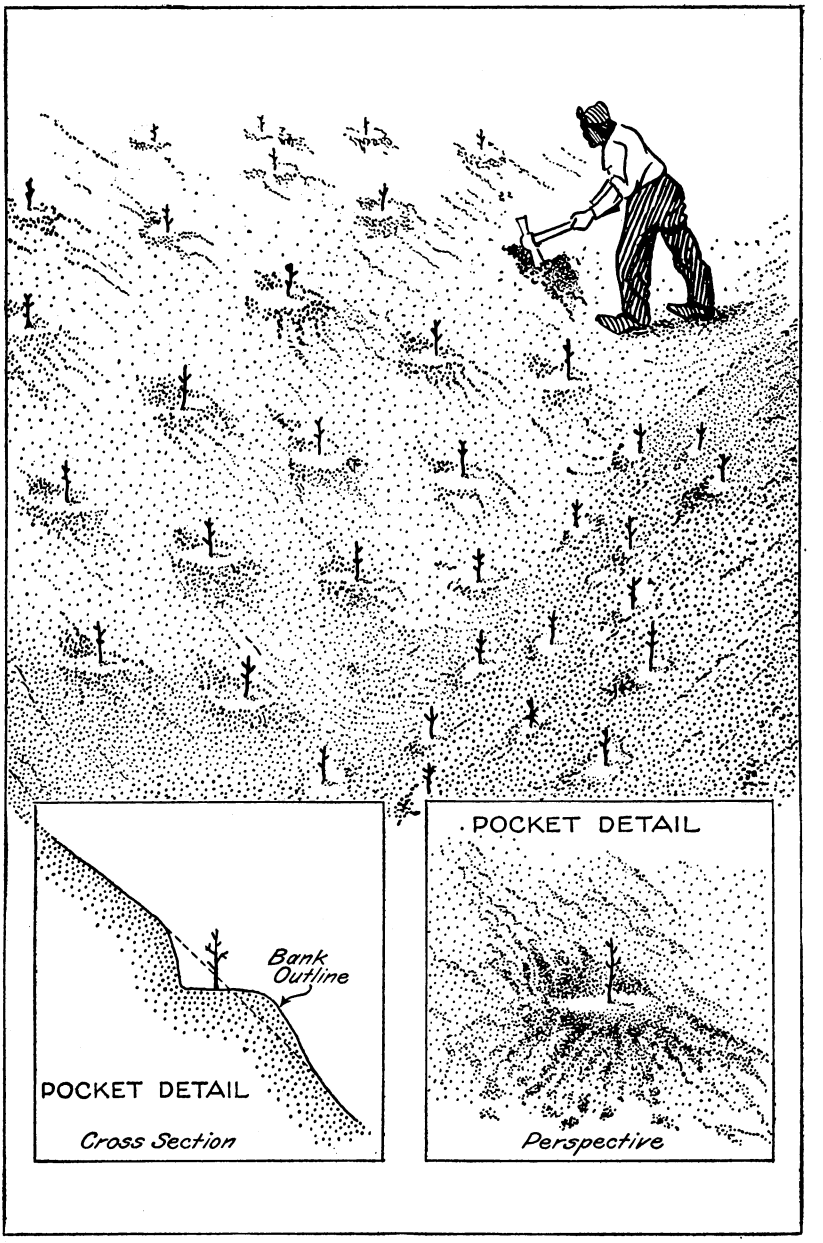

FIGURE 11.—The pocket method of planting seedlings is recommended for use on steep slopes if the trees are not set in contour furrows. Pockets, nitches, or shelves catch run-off and retard soil washing.

is dug in the bank in which the tree is to be set, as shown in figure 11. This is effective in helping to check rapid water run-off and thus improve soil-moisture conditions. Soil erosion is also lessened.

PURE OR MIXED PLANTING

Black locust may be planted alone in pure stands, as has been largely done in the past, but there are advantages in planting other species in mixture with it. Where steep slopes or washed or gullied lands

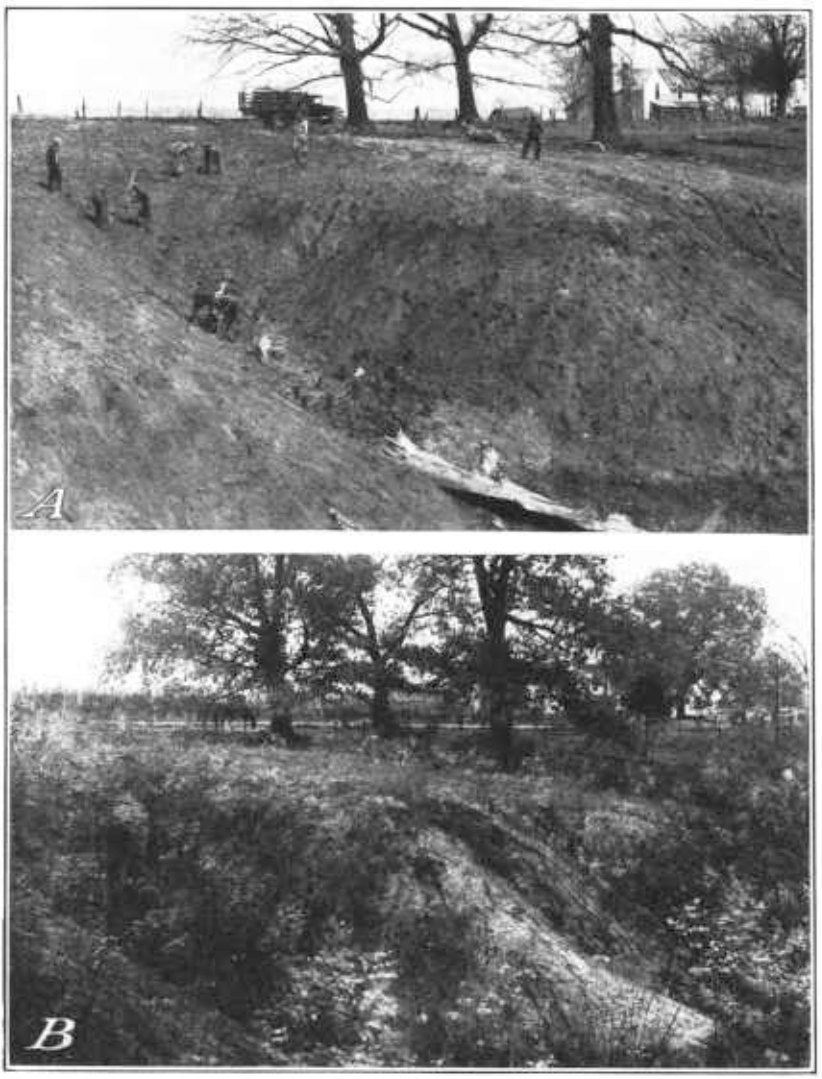

FIGURE 12.—Black locust is a particularly good tree to plant about the farm to stop erosion and put idle land to use. *A*, Planting black locust, white and red oaks, and honeysuckle vines on the sloped banks of a large farm gully. In the deep richer soils black walnut and yellow poplar (tuliptree) were planted. *B*, Appearance of the banks at the end of one season that happened to be abnormally dry. Gibson County, Tenn.

are in need of a quick cover to check erosion, it may be well to plant locust pure.

The purpose of adding other trees, shrubs, or vines is to get a heavier protective shade and bed of litter over the ground. This

favors more rapid growth, which in turn reduces the menace of the black locust borer and twig borer. Black locust is a sun-loving tree which produces only a light shade, offering insufficient shade for retaining good soil moisture. In regions where the borers are not a serious pest and in good-quality soils where growth will likely be rapid, plantings of locust alone will often give satisfactory results.

The filler trees of other species may be planted alternately in each row or solidly in alternate rows or otherwise (fig. 12). Various kinds of trees are suggested as filler trees for different regions. However, as there are few experimental data on the subject, the suggestions are largely based upon general observations. In the northeastern or cooler portion of the black locust range, red oak, sugar maple, and white ash might be planted. Farther south the trees might in-

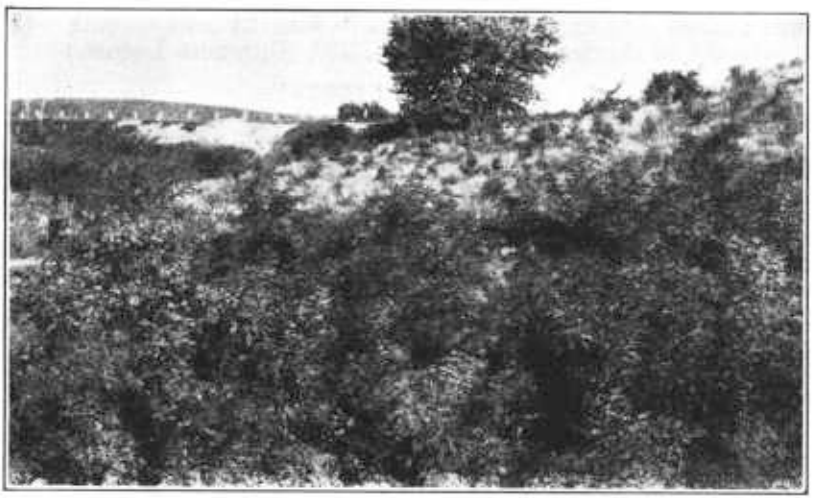

FIGURE 13.—Pines planted in pure stands on the dry ridges and black locust on the slopes of a deep gully in the central Mississippi Valley. The two kinds should not be interplanted.

clude southern red oak, on the better soils yellow poplar (tuliptree) and white ash, and on the best or agricultural soils black walnut. On the drier and poorer soils, the black oak may be considered because it is relatively hardy, although the timber product is of low grade. In connection with planting black locust, some conifers should be considered for planting pure in small blocks or patches because they will grow well on relatively dry and sterile soils not adapted to black locust. On such local areas or portions, the red, white, and jack pines may be planted in pure stands in the northeastern region, and in the middle South shortleaf and loblolly pines. There appear to be good grounds for advising against closely interplanting pines with black locust. The results appear to be poor whenever this is done. The pines should, therefore, be planted pure in small or larger blocks on the drier ridges or areas and the locust in the better soils (fig. 13). Red cedar is a very hardy tree on dry and low-grade soils; except in districts of commercial apple production, it should be used quite extensively as a filler tree, either alternately or in pure stands locally on unfavorable soils in the black locust plantation.

Natural or volunteer trees of various local species may be expected to come into black locust stands. Because of the open, light shade such stands act as a good "nurse" and favor trees that start from seeds blown in or dropped there by birds or animals.

SHIPMAST LOCUST

Among the varieties of black locust the so-called shipmast locust is important because of the straightness of its trunk, its good rate of growth, and the good quality of wood (fig. 14). The main stem or trunk is excurrent, like that of pines and yellow poplar. It is found chiefly on Long Island, N. Y., where it is thought to have been introduced about 2 centuries ago from some unknown point in Virginia. Only rarely does it produce seed, and these are mostly infertile; thus shipmast locust is reproduced only vegetatively, by means of root cuttings (4 to 5 inches in length) and sprouts. (See Department of Agriculture Circ. No. 379, Shipmast Locust.)

INJURIOUS INSECTS[1]

LOCUST BORER

The adult locust borer (*Cyllene robiniae*) is a handsome beetle, about one-half inch in length, black with yellow stripes, and with long horns or antennae. It is most frequently seen in late summer or early fall, feeding on the pollen of goldenrod. The borer is found in practically all parts of the United States where black locust is growing.

The injury is caused by the feeding of the larva or grub in the sapwood and heartwood of the trunk and of the larger branches. It makes large burrows which weaken the tree and sometimes result in its death by wind or heavy girdling. The eggs, which are laid in bark crevices, hatch into larvae or grubs that live over winter hidden in the inner bark. In the spring these larvae begin to burrow actively and feed vigorously on the wood of the tree until they pupate in July or August. The presence of the young borer is easily detected in the early spring. Pellets, damp or wet from the oozing sap, will be seen coming out of holes, mostly in the tree trunk where the bark is rough. Old attacks may be recognized by calloused swellings on the trunk or large branches.

Means of reducing borer attack on trees in forest plantations and method of control for use on individual dooryard trees are discussed on pages 22 to 25.

LOCUST TWIG BORER

In its larval stages the locust twig borer (*Ecdytolopha insiticiana*), a moth insect, causes considerable damage by eating and boring in the young, tender growing twigs in the earlier part of the growing season. It is not known that it attacks any other part of the tree or at any other season. There are two generations a year, and the winter season is passed in the pupal stages in the ground. Adult moths of the first generation appear about May or June and those of the second generation in August or September.

[1] Acknowledgment is made of the information on the locust borer, locust twig borer, and leaf miner, and helpful measures for their control furnished by Ralph C. Hall, assistant entomologist, Bureau of Entomology and Plant Quarantine, associated with the Central States Forest Experiment Station at Columbus, Ohio.

The injury to the succulent twigs often seriously slows up the current season's growth and deforms the stem. The twig borer is the chief cause of insect damage to young stock growing in nurseries,

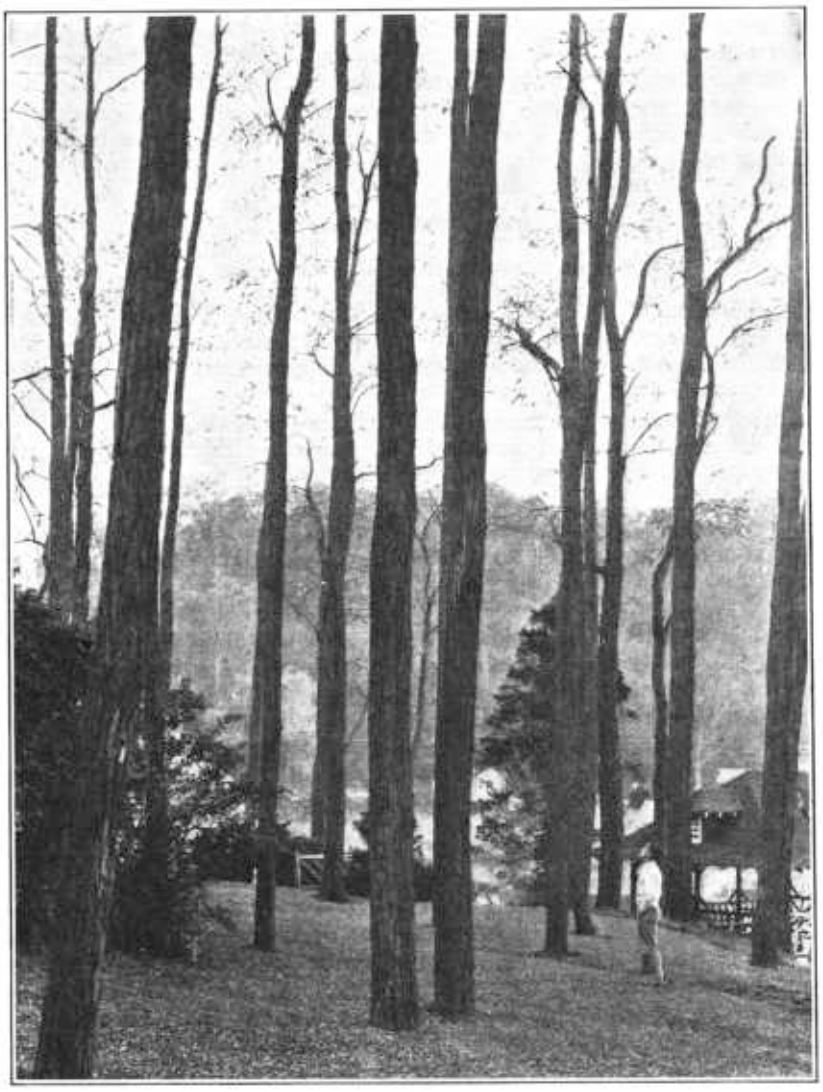

FIGURE 14.—Shipmast locust is a variety of black locust so named because of the unusual straightness of its single upright trunk. These trees, growing in Centerport, Long Island, N. Y., at the age of 65 years, average 95 feet in height and range up to 18 inches in diameter.

and also during the first few years after the trees are planted out. Some degree of control is possible in small nurseries or plantations by cutting and burning the infested twigs near the end of the first and middle of the second period of active injury, namely, in late June and early September.

LOCUST LEAF MINER

In midsummer or early fall the foliage of black locust trees often turns from its usual light green to a grayish brown. A close examination will show little left but the veins or skeletons of the leaves. The green portion, or chlorenchyma, has been eaten by an insect known as a locust leaf miner. The most common species in the Eastern States is a sawfly (*Odontota dorsalis*) but there are known to be one or more closely related insects that mine the green in the leaves. The effect is to retard the growth of the tree slightly, but nothing more serious. It is not practicable to attempt to check the insect.

CARE AND CULTIVATION

TREATMENT HELPFUL IN REDUCING INSECT ATTACK

In addition to the usual care needed by trees planted for timber production or windbreaks there are some points in handling black locust that are effective in reducing the attack and injury of harmful insects, particularly the locust borer.

Important practices in the care of young stands, that will pay well, all center around keeping the growth thrifty and vigorous. For reducing the borer attack the following practices are to be recommended:

(1) Choose favorable soils or locations for planting black locust. This is most important in localities of bad borer infestation but should always be kept in mind.

(2) Prepare the soil thoroughly so as to make a good planting bed in which it will be easy for the lateral roots to spread rapidly. Often, fair to good success has been attained by planting locust in poor or sterile soil that was well plowed or disked in advance of planting. There are insufficient data on which to base any general recommendations for adding fertilizer to the soil at the time of planting. However, experiments in adding a teaspoonful of commercial fertilizer, containing nitrogen, phosphoric acid, and potash, have shown decidedly good results in stimulated vigor during the first 2 years. The cost per acre has been reported as not more than 60 cents. Some soils require only acid phosphate.

(3) Cultivate the planted tract well for at least the first season after planting. It would be better to continue cultivation during the second year. If this is not practicable, weeding and cultivation around each tree will prove very beneficial. A mulch of straw, leaves or other vegetable matter around the tree will help in holding needed moisture and keeping the soil loose. In the Great Plains cultivation is very essential and should be kept up for a much longer period.

(4) Increase the protective ground cover to maintain vigorous growth of the trees. The black locust makes only a light shade and a thin leaf litter over the surface of the ground. Therefore the soil dries and hardens, becoming unfavorable to good rates of growth. It is therefore very desirable to interplant locusts with other trees that have heavy foliage and that are also slower growing so as not to overtop the locusts. After the young trees reach a height of 8

feet or so everything should be done to encourage volunteer growth. Weeds and low vines often afford such a desirable ground cover. The Japanese honeysuckle vine is often seen growing with black locust trees and almost always affording a beneficial ground cover. Contrary to a misconception, it rarely harms a tree by getting into the foliage. This vine is a very weak climber and should be clearly differentiated from the wild grape and kudzu, both of which are lusty climbers and commonly smother and kill trees.

(5) Provide shade for the tree trunks, if practicable. A dense growth of locust growing in deep, fertile soil well supplied with moisture, or locust trees with trunks shaded by slower growing heavy-foliaged species of trees as a rule are found to be thriftier and less subject to infestation.

(6) Protect young black locust from all grazing by livestock. It is a legume and palatable at all times of the year, and subject to heavy browsing, particularly in the dormant season, when green foliage is absent. Cattle and horses, as well as sheep and goats, browse freely on the locust twigs and branches and often break down young trees. It is also very essential to preserve a complete ground cover of vegetation and humus over the ground. By trampling, grazing and browsing, livestock quickly break up the protective cover, and the ground becomes hard and dry. This condition is very unfavorable to vigorous tree growth.

(7) Keep out fire at all times. The reason is obvious, and it should be noted specially that black locust is particularly susceptible to injury and death by burning. Young locust has a very thin bark, and the roots are shallow. Any removal of the vegetative cover from the soil will immediately be shown by its effect upon the vigor and life of locust trees, even if the fire is so light as not to cause direct injury.

Closely related is the effect of severe drought in lessening the vitality of black locust trees to a point where the borer readily overcomes the weakened resistance of the trees and severely injures or kills them.

(8) Prune back stagnated stands. As black locust is a vigorously sprouting species, it is good practice to cut clean slow-growing, stunted young trees up to 3 to 6 years of age. If this is done, preferably in the dormant season, the result should be vigorous sprouts that will be much freer of insect attack. The colonies of sprouts should be reduced to a single tree; midsummer is the best time for the cutting, as sprouting is then least vigorous.

Pruning early is a very important aid in producing a straight clean trunk. In midsummer of the second growing season after planting the one straightest and strongest central stem should be freed to grow singly by cutting off all other competing or framework stems. It is a great mistake to cut off the many weak laterals that will never compete as a central stem but are valuable in supporting the foliage and therefore furnish food for the growth of the main trunk. Vigorous growing trees might well be shaped by pruning in the first season, and conversely slow developing trees might not need pruning until their third year. Early and repeated

pruning is to be favored and will pay well in developing straight post or pole timber. A second pruning will usually be required from 1 to 3 years after the first pruning. The character of growth will determine whether later pruning becomes necessary.

Overpruning should be avoided, as severe cutting almost stops the growth of the tree. The leaves are virtually the food factor of the tree. In them is manufactured all of the substance out of which wood is made. Pruning should be done in midsummer, as there is then the least opportunity for successful sprouting.

FIGURE 15.—Stand of black locust thinned out to favor rapid growth of each tree.

(9) Thin out the less vigorous trees in black locust stands (fig. 15). They are most susceptible to infestation and often become breeding trees for insects. The survival of larvae in the spring is least on the dominant and more vigorous trees and highest on stunted trees. Quite similarly, old, overmature locust trees are dangerous breeding places; therefore, if any occur near young stands they should be cut and used.

(10) No practicable method of direct control of the locust borer is known that can be applied to large-scale or forest plantations of black locust. However, treatment for killing or controlling the borer on individual trees of special value, such as those planted on lawns or streets, may be practicable. An effective method is to spray the trunks, especially the lower parts up to 8 feet in height, with crude orthodichlorobenzene solution. This should be prepared in the following proportion: 1 gallon of orthodichlorobenzene, 1 gallon of soft water, and 1 pound of fish-oil soap or common laundry soap. The soap is dissolved in boiling water and after the mixture has been well cooled, the orthodichlorobenzene is added, and the whole stirred well. To make up the spray solution, add about 4 parts of

soft water and stir well. Early spring, about the time the young leaves begin to unfold, is the best period for applying the spray.

PRODUCTION OF TIMBER

CUTTING THE TREES

The trees should be cut during the period from late fall to late winter, in order to promote vigorous sprouting the following spring. The sprouts which grow following midsummer cutting do not usually become sufficiently hardened to withstand the winter freezings. It is also important to cut stumps low, only a few inches above the ground.

FIGURE 16.—Fifteen-year-old black locust plantation in Cayuga County (near Ithaca), N. Y. The smaller trees are marked for cutting, which will leave a stand of trees at the rate of 322 per acre. The plantation is regarded as very successful.

It is only the heartwood of black locust that is extremely durable in contact with soil. The sapwood decays more rapidly. It is usually very narrow, consisting of only the last three or four rings of new wood. For use as posts or poles, therefore, trees should preferably not be cut at such an early age or in such small sizes that a considerable portion of the wood is sapwood. By the time the tree is 6 to 8 inches in diameter on the stump it usually has enough heartwood to warrant cutting. Such trees commonly can be grown in about 12 to 15 years where soil and climate are favorable (fig. 16) or in 20 years in less favorable places. Smaller and younger

trees when cut in making thinnings to improve the growth of the stand will of course become available for use.

There is a widespread habit of allowing black locust trees to grow beyond their age of maturity, which is often 20 to 30 years. Such trees develop heart decay (fig. 17). This applies more particularly to trees grown in open stands about the farm, rather than to forest-grown trees.

FIGURE 17.—Black locust trees grow rapidly and mature at earlier ages than most forest trees. Old trees are commonly infected with the borer and some fungus diseases. Such old trees are often preserved about the home because of their flowers.

The trees from the second growth or sprout crop, will grow faster and can be harvested at least 5 years sooner than those of the original seedling crop. They are usually less subject to insect attack than trees of seedling origin. To cut the crop of trees would often prove a good means of renewing badly infested stands of black locust.

Occasionally a landowner objects to putting black locust on his place because he has heard that it is difficult to get rid of it. A sure and simple way to do this is to cut all the locust trees preferably in the spring and turn cattle, sheep, or goats on the land. They will browse the sprouts and kill out all the locusts.

POSTS FROM BLACK LOCUST TREES

The number and size of fence posts that may be cut from black locust trees of different sizes are often of interest. Obviously the cut from a tree depends upon its height, diameter, and the straightness and soundness of its trunk. In other words, it depends upon the tree's merchantable length, diameter, and soundness.

For example, a black locust tree of regular shape, measuring 8 inches in diameter (outside the bark at 4½ feet above the ground) and 50 feet in height, as shown in table 1, will on an average cut out seven round or equivalent split posts, each 7 feet in length. Of these, four will be 4-inch posts (top diameter inside the bark), two

5-inch posts, and one a 6-inch post. By way of comparison, a tree of the same diameter (8 inches) but 60 feet in height can be cut into nine posts, of which five will be 4-inch, three 5-inch, and one a 6-inch post in top diameter. The posts will be round or split and of equivalent bulk.

TABLE 1.—*Number of 7-foot fence posts that can be cut from black locust trees of different heights and diameters and of average straightness and soundness* [1]

Diameter of tree outside bark at height of 4½ feet (inches)	Total height of tree	Posts (round or equivalent split posts) from average-shaped tree			
		4-inch [2]	5-inch [2]	6-inch [2]	Total per tree
	Feet	*Number*	*Number*	*Number*	*Number* [3]
6	30	1			1
	40	1			1
	50	2			2
	60	2			2
7	30	2	1		3
	40	2	1		3
	50	3	1		4
	60	3	2		5
	70	4	2		6
8	30	3	1		4
	40	4	2	1	7
	50	4	2	1	7
	60	5	3	1	9
	70	6	4	1	11
9	40	5	3	1	9
	50	6	3	2	11
	60	8	4	2	14
	70	10	5	3	18
	80	11	6	3	20
10	40	6	4	2	12
	50	8	5	2	15
	60	11	6	3	20
	70	13	7	4	24
	80	16	9	5	30
11	40	7	5	2	14
	50	10	6	3	19
	60	13	7	4	24
	70	17	9	5	31
	80	20	11	6	37
	90	23	13	7	43
12	40	9	6	3	18
	50	12	7	4	23
	60	16	9	5	30
	70	20	11	6	37
	80	24	14	7	45
	90	28	16	9	53
13	60	20	12	7	39
	70	24	14	8	46
	80	28	17	9	54
	90	32	20	11	63
14	60	23	14	8	45
	70	28	17	10	55
	80	33	20	12	65
	90	38	24	13	75
15	60	26	16	10	52
	70	32	20	12	64
	80	39	25	14	78
16	60	30	19	11	60
	70	37	23	14	74
	80	45	28	17	90
17	60	33	22	13	68
	70	42	26	17	85
	80	52	32	20	104
18	60	38	25	15	78
	70	48	30	19	97
	80	58	36	23	117
19	70	54	33	22	109
	80	66	40	26	132
20	70	60	37	25	122
	80	73	44	29	146

[1] Computed by the Central States Forest Experiment Station (U. S. Forest Service). The values are calculated and have not been checked by actual cutting operations.
[2] Measured inside bark.
[3] The sums of the 3 previous columns.

The production of posts from trees up to 20 inches in diameter can be found in table 1. The assumption is that the trees are sound and comparatively straight; therefore, in using the table necessary deductions should be made for defect or deformity.

The number of split posts that can be cut from round posts, bolts, or billets is shown in table 2. For example, a round stick measuring 10 inches (inside the bark at the small end) will split out six 4-inch posts, or four 5-inch, or two 6-inch split posts.

PROFITS

It is doubtful whether as large net money profits per acre have been derived in periods of 10 to 20 years from the growing of any other forest-tree species as those that are known definitely to have accrued from the growing of black locust. These are mostly from $5 to $10 an acre yearly but range up to more than $20 (figs. 18 and 19).

TABLE 2.—*Number of split posts of specific diameters or sizes that can be derived from round posts*[1] *of different diameters*

Diameter of split posts (*inches*)	4-inch	5-inch	6-inch	7-inch	8-inch	9-inch	10-inch	11-inch	12-inch	13-inch	14-inch	15-inch	16-inch	17-inch	18-inch	19-inch
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
4	1	1	2	3	4	5	6	7	8	10	12	14	16	18	20	22
5	-----	1	1	2	2	3	4	5	5	6	8	9	10	11	13	14
6	-----	-----	1	1	1	2	2	3	4	4	5	6	7	8	9	10

[1] Measured inside the bark at the small end.

NOTE.—The numbers are complete as they stand. For example, a 10-inch round post will split out 6, 4-inch split posts, or 4- 5-inch split posts, or 2, 6-inch split posts.
Compiled by the Central States Forest Experiment Station, U. S. Forest Service.

All these examples are taken from stands grown in good soils or in regions naturally favorable to the trees. On the other hand, cases of utter failure occur, although confined mostly to instances where the trees were grown under conditions or in regions known to be generally unfavorable. For example, in parts of Pennsylvania, West Virginia, Kentucky, and Indiana which are generally supposed to be in the favorable range of black locust, there have been conflicting reports regarding the success and profit in growing black locust.

FURTHER INFORMATION

In considering the question of planting land to black locust trees or growing them, it is very advisable to consult your State forestry department, your agricultural extension service, your agricultural county agent, who is the local representative of the State college of agriculture, or the Forest Service, United States Department of Agriculture. These agencies are in a position to offer advice and give to the States assistance in securing tree seeds or seedlings.

FIGURE 18.—This 20-year-old black locust grove was started by planting year-old seedlings on a worn-out and gullying field. It contains 1,880 posts per acre, worth 10 cents in the tree, or $188 per acre. This is an average yearly gross income of $8.40 per acre.

FIGURE 19.—A valuable stand of tall straight black locust trees, age 27 years from time of planting, Bartholomew County, Ind. The trees range up to 14 inches breast-high diameter and 80 feet in height. Many of the trees will cut from 30 to 50 fence posts each, and a few 60 to 65 posts.

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